

Abstract

The present invention is directed toward a magnetic resonance based material detection system that includes a resonator probe which is highly resonant, is cost effective and has a compact magnetic structure with a low cost tuning mechanism and high quality factor (Q). The probe is relatively immune to radio frequency interference and can be used in close proximity to other resonator probes of similar design, complementary sensing equipment, and electromagnetic shielding due to its low external magnetic field. It is preferred that, if the magnetic resonance based detection equipment is used with complementary sensing equipment that uses x-rays, the portion of shielding that intersects the x-ray beam is made of thin material of a conductive nature which retains electromagnetic shielding properties while causing minimal attenuation to x-rays. In one embodiment, the resonator probe is a rectangular-shaped single turn toroid fabricated from copper sheets. The resonator probe also has adjacent walls forming an inspection volume such that materials can be passed through this inspection volume.